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Challenging Stereotypes of Teens: Reframing Adolescence as Window of Opportunity

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In this review, we seek to challenge negative stereotypes of adolescence and unpack the many ways that the developing brain contributes to positive development during the adolescent years. In particular, we will show that risk-taking is not inevitable and risks can be highly adaptive and positive; adolescents are not overly self-centered but engage in other-oriented prosocial behaviors in remarkable ways; adolescents are not only susceptible to negative peer influence but can resist negative peer influence and conform more to positive peer influence; and adolescents do not orient away from the family, but the family remains a constant and important source of influence into adolescence. We outline considerations that researchers can use to reframe their research questions to provide a more balanced perspective on adolescent development, thereby promoting positive development.

Public Significance Statement
Adolescents have long been characterized as irresponsible, self-centered, and are assumed to engage in socially unacceptable risky behaviors, be overly susceptible to negative peer influence, and orient away from the family. Such characteristics of adolescence are largely based on negative stereotypes of adolescence. We challenge these stereotypes of adolescence and unpack the many ways that the developing brain contributes to opportunities for positive development during the adolescent years.

Keywords: adolescence, brain, positive development

Adolescence is the second decade of human development, which represents a uniquely sensitive period wherein many social behaviors begin to emerge, change, and become susceptible to contextual influences. Adolescents have long been characterized as irresponsible, self-centered, and are assumed to engage in socially unacceptable risky behaviors, be overly susceptible to negative peer influence, and orient away from the family. Such characteristics are largely based on negative stereotypes of adolescence that are perpetuated by media depictions. Indeed, parents, adolescents, and college students in the United States view teenagers more negatively than they view children, including seeing adolescents as more rebellious (e.g., testing limits) and peer-oriented (e.g., easily influenced by friends; Buchanan & Holmbeck, 1998). At the same time, the adolescent brain has been portrayed as defective and broken. For instance, media depictions of the adolescent brain show comical images of teens' brains with regions dedicated to sex, sleep, emotional liability, and being "under construction." This may contribute to public perceptions of the teenage brain, which are largely negative. For example, adolescents and adults describe the teenage brain with negative behaviors (e.g., "irresponsible," "lazy," "irritating") more often than positive behaviors (e.g., "independent," "kind," "creative"; Altikulaç et al., 2019).

Such negative stereotypes are particularly concerning because they can affect adolescents' self-concept and behaviors, becoming self-fulfilling prophecies (Buchanan & Hughes, 2009).

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If adolescents believe adolescence is a time of irresponsibility, school disengagement, or heightened risk taking, they may engage more in that behavior because youth's conceptions about adolescence reflect what they see as normative, which they may use as a standard for their own behavior. Indeed, when adolescents hold more negative stereotypes of adolescence, they are more likely to engage in risk taking, have more conflictual family relationships, and show poorer academic performance (Buchanan & Hughes, 2009; Qu et al., 2018, 2020). Moreover, when adolescents believe that adolescence is a time of decreasing responsibility to the family, they show longitudinal increases in prefrontal cortex (PFC) activation when engaging in cognitive control as well as increases in risk-taking behavior, suggesting that holding negative stereotypes of adolescence is associated with changes in neural circuits that support cognitive control (Qu et al., 2018). Thus, some of the behaviors that emerge during adolescence may be byproducts of stereotypes that become self-fulfilling prophecies, which create changes in behavior and brain function that might not otherwise exist.

In this review, we seek to challenge several stereotypes of adolescence and unpack the many ways that the developing brain contributes to positive development during the adolescent years. In particular, we will show that risk taking is not inevitable and risks can be highly adaptive and positive; adolescents are not overly self-centered but engage in other-oriented prosocial behaviors in remarkable ways; adolescents are not only susceptible to negative peer influence but can resist negative peer influence and conform to positive peer influence; and adolescents do not orient away from the family, but the family remains a constant and important source of influence into adolescence. We draw on findings from experimental neuroimaging research. Our intention is not to provide a thorough background on the developmental neuroimaging literature, and so we recommend several reviews for this foundational work (see Crone & Dahl, 2012; Telzer et al., 2018). Many different neural regions and patterns of activation are presented. In short, we discuss regions involved in reward processing (e.g., ventral striatum, ventromedial prefrontal cortex [vmPFC]), cognitive control (e.g., prefrontal cortex, inferior frontal gyrus [IFG]), and social cognition (e.g., temporoparietal junction [TPJ]; posterior superior temporal sulcus [pSTS]).

Risk Taking Is Not Inevitable and Can Be Positive and Adaptive

For decades, adolescence has been portrayed as a period of increased risk-taking behaviors, including drug use, reckless driving, unsafe sexual practices, and other socially undesirable behaviors, which result in harmful health outcomes (Arnett, 1999). Indeed, across Western and non-Western countries, risk taking follows an inverted U-shaped pattern, peaking in mid-late adolescence (Duell et al., 2016). This heightened risk taking during adolescence contributes to a 270% increase in mortality and morbidity rates from childhood to adolescence, with nearly 60% of the underlying causes of deaths in adolescence due to preventable, risky behaviors (Centers for Disease Control and Prevention [CDC], 2020). However, although mortality increases from childhood to adolescence, the actual number of deaths is extremely low, with the survival rate of U.S. high school students at 99.9% (crude rate is 14 deaths per 100,000; CDC, 2020), suggesting that most youth go through adolescence without experiencing major health problems.

Developmental neuroscientists have proposed several psychobiological models to explain the neurodevelopment that underlies heightened risk-taking behaviors during adolescence, including the dual system model (Steinberg, 2010), imbalance model (Casey et al., 2011), and triadic model (Ernst, 2014). A key feature of these theories is that relatively more protracted development of the PFC inhibits adolescents' cognitive control, whereas rapid development in limbic regions (e.g., ventral striatum [VS], amygdala) stimulates teenagers' sensation-seeking behaviors. Guided by this theoretical perspective, a rich neuroimaging literature has demonstrated that adolescents exhibit increased activation in the VS and reduced activity in the PFC during reward processing and risk taking compared to children and adults (see Casey et al., 2011). Although these theoretical models and empirical studies have greatly helped legal policymakers understand teens' competence and sensitivity (e.g., Steinberg, 2009), they may also lead to an overreliance on adolescents' limited ability to exert cognitive control to explain adolescent risk taking and generate a public stereotype that risk taking during adolescence is inevitable.

Cognitive Control Is Flexibly Engaged During Risk Taking

Cognitive control refers to one's ability to override an emotional response and inhibit reward-seeking behaviors (Crone & Steinbeis, 2017). The generalization that adolescents have relatively slower development of the PFC and hence lack cognitive control may be overstated. While a substantial body of neuroimaging work has suggested that adolescents show poorer cognitive control than adults in many domains (see Somerville & Casey, 2010, for review), other cross-sectional studies show that adolescents are able to exhibit equivalent or even better cognitive control than adults in some contexts, as paralleled by activation in the flexibly engaged PFC (see Crone & Dahl, 2012). For instance, using the go/no-go cognitive control task paradigm, empirical evidence shows that adolescents exhibit better cognitive control for previously learned high-value targets than low-value targets (Insel et al., 2019), whereas they display

decreased cognitive control for emotional targets relative to neutral targets (Lee et al., 2018), suggesting adolescents are capable of flexible forms of cognitive control, which largely depend on environmental contexts (see Davidow et al., 2018, for review). These findings do not necessarily question that the PFC becomes more "online" with advancing age, following a protracted developmental trajectory. Instead, these findings point to considerable individual differences in the development of the PFC and suggest that cognitive control deployment during adolescence may be less automatic and more flexible.

The ability to flexibly engage in cognitive control is developmentally adaptative, allowing adolescents to explore their environment and engage in risks that promote learning. For instance, adolescents outperform children and adults in learning (i.e., improvements in performance across the task) in high-risk relative to low-risk environments (Humphreys et al., 2016). Similarly, compared to children, adolescents adaptively adjust their behaviors more frequently based on feedback during risk taking (i.e., take more risks after positive feedback and fewer risks after negative feedback; McCormick & Telzer, 2017). Importantly, such improvements in learning in a risk-taking context are underpinned by age-related increases in both cognitive control (i.e., PFC) and reward-related (e.g., VS) neural activation, as well as increased functional connectivity between these brain regions during adolescence (McCormick & Telzer, 2017). These findings suggest that risk taking may emerge, in part, as a result of increasing engagement in learning from the environment during adolescence, which is subserved by the flexibility of the cognitive control network during adolescence.

Adaptive Risk Taking

A common misconception about adolescent risk taking is that risky behavior is noneffortful and conducted for sensation acquisition without regard for adverse outcomes. However, recent theoretical work suggests that cognitive control and strategic computation are engaged during adolescent decision-making (see Do, Sharp, & Telzer, 2020). This emerging notion is backed by research focusing on adaptive risk taking in adolescents. One type of adaptive risk taking is based on the expected value (EV): When the EV of a risky decision is greater than that of the safe decision, it is strategic (i.e., adaptive) to make a risky decision. The tracking and utilization of EVs in decision-making begin to emerge during adolescence. In fact, adolescents outperform adults in maximizing the rewards associated with risky options by tracking changes in the EVs, which is accompanied by increased activity in the VS (Barkley-Levenson & Galván, 2014). Importantly, this hyperactivation in the VS as a function of EV is not observed in adults, suggesting that adolescents' heightened sensitivity to rewards may also be the impetus behind their rational and adaptive decision-making. Our recent longitudinal neuroimaging research also found that adolescents take more risks when the EV is higher and reject risks when the EV is low, an effect that increases as adolescents get older (Kwon et al., 2022). Notably, the development of functional connectivity between VS and TPJ/pSTS decreases across adolescence when taking adaptive risks, suggesting that adaptive risks in early adolescence rely on the integration of reward processing and social cognition, but this decreases across adolescence, perhaps as they develop more mature and independent decision-making that no longer relies on thinking about others (Kwon et al., 2022). These findings suggest that adolescents can be rational and strategic while making risky decisions, and functional development of the VS and its connectivity with social cognitive regions plays a critical role in adolescents' adaptive risk-taking behaviors.

Positive Risks

The detrimental outcomes associated with risky behaviors (e.g., substance use, delinquency) have fostered the notion that risk taking during adolescence is maladaptive. Indeed, many socially unacceptable risks (e.g., reckless driving, unsafe sexual behaviors) are perceived as negative, as they incur many health-related consequences. However, not all risk taking is negative; instead, adolescents may engage in risky behaviors that are positive, prosocial (see Do et al., 2017; Te Brinke et al., 2022) and have beneficial developmental outcomes (see Duell & Steinberg, 2019). Positive risks are considered those that are socially acceptable and do not incur health-related consequences, such as trying out for a challenging sport (Duell & Steinberg, 2019). Disclosure of intimate information is another example of positive risk taking that may be socially salient during adolescence, which is beneficial for building relationships with peers but also involves the risk of rejection or embarrassment. Research shows that self-disclosure in youth recruits brain regions observed in risk taking—the VS and PFC (Vijayakumar & Pfeifer, 2020), suggesting positive and negative risk taking share some overlapping neural correlates in adolescents. Similarly, recent evidence suggests that positive and negative risk taking may share similar developmental mechanisms such that both positive (e.g., socializing with peers during COVID-19) and negative risk-taking behaviors (e.g., falsifying vaccination reports) are associated with sensation seeking in adolescents (Te Brinke et al., 2022). Thus, the tendency to seek out thrilling experiences may lead adolescents to engage in negative risks in some instances but positive risks in others. Interestingly, adolescents' self-reported positive risk-taking tendencies, but not negative risk-taking tendencies, are associated with greater activation in the dorsomedial prefrontal cortex (dmPFC) while making

risky choices relative to safe choices, suggesting that positive and negative risk taking may be psychologically distinct despite sharing some overlapping processes (Duell et al., 2022). Though positive risk taking has received little attention, especially in neuroimaging studies, these findings elucidate the importance of adolescent brain development in contributing to positive youth behavior, promoting adolescents' learning, exploration, and thriving.

Cultural Variation in Risk Taking

Adolescents around the world grow up in a variety of cultures and backgrounds, each with its own set of customs, beliefs, and expectations that guide adolescent behaviors and development. Indeed, risk taking may be more common in cultures that perceive the adolescent period as a time of "storm and stress," and less common in cultures that believe adolescence is not characterized by excessive risk taking (Qu et al., 2016). The adolescent brain is tuned to the sociocultural context (Blakemore & Mills, 2014); therefore, the extent to which cognitive control and reward sensitivity are activated in the adolescent brain may be impacted by youth's culture (Qu et al., 2021).

Macrosystem factors, especially adolescents' cultural background and values, play an important role in shaping adolescents' neural responses during risk taking. For instance, Latinx adolescents with greater family obligation values show decreased activation in the VS when receiving rewards during risk taking and increased PFC activation during behavioral inhibition (Telzer et al., 2013b). Thus, cultural values may alter the way risks are processed and shape cognitive control. In our cross-cultural work, Chinese late adolescents exhibited improvements in cognitive control over time, whereas American adolescents showed significant declines in cognitive control (Telzer et al., 2017). Chinese youth's improved cognitive control was paralleled by increased activation in and functional connectivity between the IFG and VS over the course of a cognitive control task, whereas brain activation and functional connectivity in these regions were low in American youth. Differences in the cultural value of self-improvement motivations explained these cultural differences in cognitive control (Telzer et al., 2017). In another study, we found that while American late adolescents engaged in greater risky exploration compared to their Chinese counterparts, Chinese adolescents who defined themselves as a unique person recruited the PFC and anterior insula (AI), which were associated with heightened risky exploration (Qu et al., 2019). Thus, cognitive control and risk taking are not hard-wired into the developing brain but are shaped by the cultural context.

Conclusions

Emerging evidence from neuroimaging studies demonstrates that the adolescent brain is rapidly developing, allowing them to flexibly engage cognitive control in different environments and perform valuation-based adaptive risks. The potential benefits of risk taking become apparent when considering the developmental tasks during adolescence are to explore and learn how to obtain autonomy, sufficiently make decisions, and form their own identity (Nelson et al., 2005). On the way to fulfilling their developmental tasks, adolescents could not succeed if they did not take risks. Importantly, evidence shows that adaptative and positive risk-taking behaviors share the same neural circuits as negative risk taking and are both predicted by sensation seeking, suggesting the possibility of redirecting an orientation to negative risks toward more positive and adaptive risks to ultimately promote youth's positive development.

Adolescents Are Not Overly Selfish but Are Remarkably Other-Oriented and Prosocial

Mainstream stereotypes of adolescents describe them as impulsive and self-oriented, motivated by hedonic pleasures. However, while adolescents do engage in selfish and hedonic behaviors that purely benefit themselves, adolescents are also oriented toward eudemonic rewards and often leverage their heightened sensitivity to rewards for the sake of being prosocial (Telzer, Fuligni, et al., 2014). In addition to reward processing, adolescence is a time of neural development of the "social brain," a network of regions that involves processes centered on the self, such as integrating self attributes from the perspective of others and monitoring self-centered impulses, and the other, including mentalizing and perspective-taking (Crone & Fuligni, 2020). The social brain includes regions such as the TPJ, pSTS, and dmPFC. Neuroimaging research additionally highlights the crucial role of the medial PFC (mPFC) as a hub for integrating information about the self and others. Connectivity between the mPFC and the TPJ, VS, and temporal cortex indicates that these regions not only work in tandem to contextualize adolescents' self in the world, but also that the processes utilizing these regions are likely formed in an intertwined fashion (Crone & Fuligni, 2020). The revelation that the neural systems utilized to think about the self and others are not bifurcated offers us new considerations for how adolescents contribute to the world around them and allows us to adopt a more nuanced understanding of the neurobiological and psychosocial factors that underlie how teenagers conceptualize the self and help others.

Prosocial Development

Adolescence is a sensitive period for other-oriented prosocial behaviors during which adolescents learn how to contribute to society, whether it be to family, peers, or their community (Fuligni, 2019). Indeed, adolescents give more

than do children (Steinbeis et al., 2012), especially to their friends and family relative to unfamiliar peers or strangers (Karan et al., in press). Neuroimaging research further highlights developmental changes in brain activation in reward, social cognition, and cognitive control-related brain regions when engaging in prosocial behaviors. For instance, VS activation is elevated in mid-adolescence relative to childhood and adulthood when winning money for their family (Braams & Crone, 2017). Moreover, early adolescents show greater activation in social-cognitive regions, including the dmPFC and pSTS, than late adolescents when making prosocial decisions in the presence of peers (Van Hoorn et al., 2016), and early adolescents show greater activation in the pSTS relative to children and mid-adolescents when making prosocial decisions (Do et al., 2019). Finally, regions involved in cognitive control (ventrolateral and dorsolateral PFC) show increasing activation from childhood to late adolescence when giving to friends, family, and unknown peers (Karan et al., in press). Together, findings underscore adolescence as a potential sensitive period during which social-, cognitive-, and reward-related neural regions come online to promote other-oriented behaviors. Development of these neural networks may promote flexibility in social decision-making as adolescents learn to distinguish between behaviors that solely benefit themselves and those that benefit family, peers, and society (Karan et al., in press).

Other-Oriented, Prosocial Behaviors Promote Belonging, Meaning, and Health Benefits

Prosocial behaviors foment a sense of belonging, agency, and achievement (Fuligni, 2019). Youth who engage in prosocial behaviors report better mood and positive affect and a greater sense of belonging to their peers and teachers, which buffers against depressive symptoms over time (Bukowski et al., 2010) and even decreases cortisol during stressful occurrences (Heinrichs et al., 2003). Further, on days when adolescents provide instrumental support to their family, they feel a greater sense of happiness and role fulfillment (Telzer & Fuligni, 2009).

The benefits of prosocial behaviors are strongest among adolescents who gain a sense of meaning from engaging in such behaviors. For instance, a meta-analysis revealed that community service during adolescence is associated with positive academic, personal, social, and civic outcomes, but only when adolescents have the opportunity to reflect on and process the meaning of their community service (van Goethem et al., 2014). Moreover, adolescents who show greater VS activation when making prosocial decisions for their family report a greater sense of happiness and role fulfillment when they help their family in daily life (Telzer et al., 2010). VS activation to prosocial rewards may represent a motivational orientation toward eudaimonic pleasures that provide a sense of value and meaning, whereas VS activation to personal rewards may represent a motivational orientation towards hedonic, self-oriented pleasures. This differential orientation has important implications for youth's adjustment. Indeed, heightened VS activation to risky or self-oriented rewards is related to increases in risk taking and depressive symptoms across adolescence, whereas VS activation in response to prosocial rewards predicts declines in depressive symptoms and risky behavior (Telzer et al., 2013a; Telzer, Fuligni, et al., 2014). Importantly, low VS activation in response to prosocial rewards is associated with increases in risk taking and depression (Telzer et al., 2013a; Telzer, Fuligni, et al., 2014). Thus, prosocial behaviors can promote a sense of self-worth, belonging, and happiness for youth, but they can also be related to detriments in well-being for those who do not gain a sense of meaning from helping.

The Intersection of Prosocial and Risk-Taking Tendencies

The intersection of self- and other-oriented rewards provides a unique opportunity in adolescence for engaging in behaviors that may be risky but also beneficial to others (i.e., prosocial risk taking; Do et al., 2017). Importantly, there are adolescent-specific peaks in VS activation for both self-oriented (Braams et al., 2014) and other-oriented rewards (Braams & Crone, 2017). Moreover, the same neural systems that support risk taking also support prosocial behaviors. For instance, the valuation system, including brain regions such as the VS that code reward value, is activated when adolescents engage in risks and also when they engage in prosocial other-oriented behaviors (e.g., Telzer, Fuligni, et al., 2014). Indeed, both prosocial and risk-taking tendencies are predicted by a similar behavioral trait—reward sensitivity—suggesting that the tendency to seek out rewards promotes both risky and prosocial behaviors (Blankenstein et al., 2020).

Initial evidence suggests that risk-taking and prosocial behaviors are linked within individuals. For instance, prosocial and rebellious behaviors are positively correlated across adolescence (Blankenstein et al., 2020). Moreover, on days when adolescents tend to be risky, they are also more likely to engage in prosocial behaviors if they also crave social interactions (Armstrong-Carter et al., 2021). Interestingly, risk-taking and prosocial behaviors converge across adolescence, such that they are anticorrelated early in adolescence but become positively correlated by mid-adolescence (Armstrong-Carter et al., 2022). This highlights that teens who tend to be more prosocial also tend to engage in more risk taking, suggesting that adolescents do not just develop either risk-taking or prosocial tendencies, but they develop both, in tandem.

Together, findings suggest that adolescence is a sensitive period when teens are high in risk taking and, at the same

time, high in other-oriented motivations. Enhanced development of neural systems involved in reward valuation (e.g., VS), which underlies sensation seeking, as well as neural systems involved in mentalizing and integrating the self and other (e.g., mPFC), makes adolescents especially well poised to take risks with the broader goals of helping others. These findings underscore the value of harnessing adolescents' risky tendencies to promote positive, other-oriented behaviors.

The Cultural Significance of Prosocial Actions Among Adolescents

Due to its very nature, prosocial behaviors have the potential to enact substantive and sustainable change beyond the microsystem. Most of the civil and sociopolitical movements that are called the zeitgeist of our times have been spearheaded by adolescents. One needs to look no further than the Fridays for Future protests, the March for Our Lives organization, and the Black Lives Matter movement to see the remarkable action that the youth have been propelling.

Intergroup contexts can impact prosocial and giving behavior. Indeed, children and adolescents are more likely to be prosocial to ingroup relative to outgroup members but will help outgroups when there is a higher reward inequity (i.e., outgroup can earn more than the self), and this is supported by heightened VS-pSTS activation (Do & Telzer, 2019). A study evaluating prosocial behaviors in conflict settings found that youth who engaged in prosocial action at a young age, especially those who did so in the face of sectarian beliefs, were more likely than their older peers to take part in social and civic engagement later in life (Taylor et al., 2018). Similar studies among youth in settings of protracted conflict show that youth with prosocial tendencies not only move to aid individuals from outgroups, but they also support the change of structures and systems that they do not experience (Taylor & McKeown, 2021). Moreover, during the COVID-19 pandemic, adolescents donated more to doctors and individuals who were either immunocompromised or sick than to their friends or unknown peers (van de Groep et al., 2020).

Not all adolescents have access to the same opportunities to engage in prosocial behaviors (Armstrong-Carter & Telzer, 2021). For example, large classrooms and low budgets may impede some schools from providing teens with the opportunities to participate in prosocial activities, and this is more common in schools serving populations of immigrants, ethnic minorities, and low socioeconomic backgrounds. It is equally critical to question how we define prosocial activity; Black youth, for instance, tend to be involved in prosocial activities that some may define as nontraditional, including providing family financial assistance, participating in cultural artistic expression through poetry and hip-hop, and taking part in youth-led social movements (Ginwright, 2010). Paying attention to the inequitable distribution of opportunities to participate in prosocial behavior as well as interrogating how researchers define prosocial activity is imperative for our understanding of prosocial development.

Adolescents Are Not Only Influenced by Their Peers in Negative Ways but Can Resist Negative Influence and Conform to Positive Peer Influence

Prevailing conceptions of adolescence characterize teenagers as overly susceptible to peer influence, which largely results in negative outcomes such as deviancy, substance use, and health risk behaviors. However, although adolescents' risk taking is often shaped by the risk taking of others in the peer group (Bukowski et al., 2008), adolescents are also susceptible to positive influence from their peers, such as engaging in prosocial behavior (Van Hoorn et al., 2016), conforming to socially acceptable peer norms (Do, McCormick, & Telzer, 2020), and being buffered away from risky behavior (Ahmed et al., 2020; Cascio et al., 2015). Additionally, peer influence may be overstated, as evidence suggests adolescents can stay firm in their beliefs and attitudes, resisting peer influence (Do, McCormick, & Telzer, 2020). Importantly, peer conformity is not monolithic, as neural sensitivity and cultural factors contribute to individual differences in peer influence susceptibility. Thus, the conception of excessive negative peer influence in adolescence may be exaggerated and may obscure the many ways in which peers can positively impact adolescents' behaviors.

Peer Influence Promotes Positive Behaviors and Buffers Negative Behaviors

Adolescents are particularly attuned to the thoughts and actions of their peers, and this plays a large role in their own goals and behaviors (Crone & Dahl, 2012). While most research has focused on this orientation toward peers as a contributor to health risk behaviors, research has highlighted that, similar to negative peer influence, susceptibility to positive and prosocial influence is also highest in adolescence (Ahmed et al., 2020; Foulkes et al., 2018; Knoll et al., 2015). Interestingly, when presented with a variety of socially acceptable (e.g., healthy behaviors, positive social interactions) and socially unacceptable (e.g., negative risk-taking behaviors, aggression) behaviors, adolescents are more likely to conform to their peers' attitudes on socially acceptable behaviors than socially unacceptable behaviors, suggesting that adolescents are selective in their conformity, and peers may promote more positive than negative influence (Do, McCormick, & Telzer, 2020). Moreover, when alone, adolescents tend to be more selfish, but when a peer is present, they are more altruistic (Sullivan et al., 2022). In particular, adolescents are less likely to accept rewards involving advantageous inequity (i.e., receiving more than their peers)

and are more likely to accept rewards involving disadvantageous inequity (i.e., receiving less than their peers). Thus, peer presence promotes more altruistic behavior by both decreasing selfish behavior and increasing other-oriented behavior. In addition, adolescents contribute more to public goods in the presence of their peers, especially when their peers provide positive feedback for donating, and this is supported by heightened activation in the dmPFC, TPJ, precuneus, and pSTS (Van Hoorn et al., 2016). Interestingly, specific hormonal profiles may impact prosocial peer influence. Making prosocial decisions after observing a highly prosocial peer is associated with more prosocial conformity and heightened activation in the pSTS, TPJ, insula, orbitofrontal cortex (OFC), and caudate, but only for individuals with high testosterone and low cortisol (Duell et al., 2021). Taken together, these findings suggest that prosocial conformity may be supported by heightened perspective-taking, social cognition, and reward-related processing.

Peer influence can also be positive by discouraging negative behaviors. For example, adolescents are less likely to engage in risk taking if their peers discommend such behaviors (Ahmed et al., 2020). Moreover, mid-adolescents, relative to younger or older adolescents, are the most likely to conform to their peers to make more safe decisions (Braams et al., 2019). Similarly, adolescents make fewer risky decisions (e.g., running through red lights during simulated driving) in the presence of a low-risk peer, and greater activation in the response inhibition network (IFG and Basal Ganglia) during a cognitive control task is associated with making fewer risky decisions in the presence of a low-risk peer (Cascio et al., 2015), suggesting that peer influence may be a regulated process, and adolescents can pick up on cues from peers to make thoughtful decisions to orient away from risky behavior.

Individual Differences in Peer Influence Susceptibility

The general assumption is that all adolescents are overly susceptible to peer influence. However, peer influence susceptibility is normally distributed across adolescents (Prinstein et al., 2011), such that some individuals are very susceptible to peer influence, whereas others are more resistant (Brechwald & Prinstein, 2011). Recent studies have begun to identify neural markers that can indicate which individuals are most susceptible to their peers. For instance, VS sensitivity to social rewards and threats moderates the link between peer norms and risk taking (Telzer et al., 2021). In particular, adolescents who display high VS sensitivity and are exposed to negative peer group norms engage in heightened risk taking, whereas adolescents with high VS activation but are exposed to positive peer group norms are buffered from risk taking. Thus, high VS sensitivity does not render all adolescents at risk for negative peer influence; it is only a risk factor for those in more antisocial peer contexts but is a buffer for adolescents in positive peer contexts. VS sensitivity may tune adolescents to their social environments in a for-better and for-worse way.

Importantly, adolescents with low VS sensitivity are resilient to their peer group norms, demonstrating low risk-taking behaviors regardless of whether they are exposed to positive or negative peer group norms (Telzer et al., 2021). This underscores that adolescents are not excessively influenced by their peers, and many are resilient to peer influence. Indeed, adolescents stick with their prior attitudes more often than not, indicating that, on average, adolescents may be more resistant to peer influence than popularly conceived (Do, McCormick, & Telzer, 2020). Thus, adolescents are able to stand firm in their own attitudes even when confronted with opposing attitudes by their peers. Adolescents are gaining independence, flexibly learning from their environment, and establishing personal attitudes and values, which are all thought to underlie age-related improvements in the ability to resist social influence.

Cultural Differences in Peer Influence

Cultural norms contribute to adolescents' conformity. Adolescents may feel greater pressure to align with norms stemming from their cultural background, which varies between collectivistic (greater pressure to conform to cultural norms) and individualistic (less pressure to conform to cultural norms) groups (Allen & Antonishak, 2008; Bond & Smith, 1996). For example, White adolescents are more likely to smoke if their friends do, whereas this effect is weaker for Asian Americans, African Americans, Latinx, and Pacific Islanders (Unger et al., 2001). This may reflect that White adolescents are more influenced by the behaviors of individual friends, whereas adolescents of other ethnicities are more influenced by broader cultural norms and expectations. Moreover, in instances where adolescents are exposed to multiple norms from their home and school environments, such as for immigrants and international students, individuals may have to navigate contradictory messages to regulate their behaviors and form their identities (Zine, 2001).

Adolescents' social environments can consist of members of multiple cultural groups, and behavioral conformity is often stronger for members of ingroups than outgroups (Cikara & Van Bavel, 2014). In an emotion rating neuroimaging task including Chinese international students and their White American peers, late adolescents were more likely to conform to their respective ingroups, and this conformity was supported by greater activation in reward (VS, vmPFC) and social cognition (dmPFC, pSTS, temporal pole) regions (Lin et al., 2018). Overall, these findings suggest that cultural factors regarding the individual and the peer group at large contribute to variation in peer influence processes for adolescents.

Conclusions

Concern with mitigating the negative effects of peer influence has largely led to a focus on the ways peers promote negative and risky behaviors, without considering the important role of peers in influencing positive behaviors. Evidence from behavioral and neuroimaging studies shows that peer influence can provide tremendous opportunities to buffer negative behaviors and promote positive ones, and adolescents are more resistant to peer influence than commonly conceived. Research and intervention efforts should seek to identify adolescents most likely to be susceptible to peers and work to create positive environments in ways that optimize peer influence effects to help adolescents flourish.

Adolescents Do Not Orient Away From the Family but Continue to Place Great Importance on the Family

Adolescence is often discussed as a time of orienting away from the family and toward peers. This social reorientation is thought to reflect neurobiological changes in the developing brain that create a social restructuring of adolescents' social behaviors and is evolutionarily adaptive by increasing mating opportunities and reproductive success (Nelson et al., 2005). Despite the salience of the family purportedly receding, the family remains a constant and important source of influence into adolescence. Thus, rather than being replaced by peers, adolescents' social spheres grow, with the family remaining integral social agents in their lives.

Despite the stormy estrangement and family detachment that were once thought to be inevitable in adolescence, for adolescents across diverse cultural groups, family conflict remains low and family cohesion increases (Choe et al., 2014; Fuligni, 1998; Rothenberg et al., 2016). Moreover, although the total time spent with the family decreases across adolescence, the amount of time adolescents spend communicating with their family does not decrease, and for girls, communication with their family becomes more interpersonal over time (Larson et al., 1996). Thus, the adolescent years represent a time when family relationships become more intimate, and adolescents turn to their family for guidance and support, particularly when it comes to moral and ethical values (Nickerson & Nagle, 2005; Speicher, 1994).

Parental Social Buffering

Parental social buffering, by which the presence of parental figures helps their offspring to regulate stress and engage in emotional regulation, is critical for survival and is observed across species. Some have suggested that the potency of parental social buffering decreases with the transition from childhood to adolescence as youth develop more mature modes of coping and turn to their peers to better regulate their stress responses (e.g., Doom et al., 2015). Despite the purported decline in the need for parental social buffering in adolescence, parents continue to play an important buffering role, promoting their adolescents' effective emotion regulation.

Parental social buffering facilitates the adaptive maturation of neural regulation of emotion by promoting connectivity between cognitive and affective neural networks. For instance, when alone, adolescents relative to children display poorer cognitive control in the presence of socially appetitive cues in their environment (e.g., Perino et al., 2016; Somerville et al., 2010), suggesting that adolescents may benefit from social buffering in appetitive social contexts. Indeed, when their caregivers are physically present, adolescents show improved emotion regulation of appetitive social cues (Rogers et al., 2020). At the neural level, parental social buffering elicits heightened mPFC activation as well as amygdala–mPFC connectivity to appetitive social cues (Rogers et al., 2020). Thus, caregivers may promote recruitment of the mPFC to downregulate affective processing of the amygdala, thereby facilitating effective emotion regulation within socially salient contexts.

Parental social buffering also facilitates emotion regulation in risky contexts. For example, in the presence of their parents, adolescents make fewer risky decisions compared to when alone (Telzer, Ichien, & Qu, 2015). This is paralleled by less VS activation during risky decision-making, suggesting that parental social buffering of risk taking may occur by reducing the reward value of engaging in risks (Telzer, Ichien, & Qu, 2015), a finding that is specific to parents and not to unknown adults (Guassi Moreira & Telzer, 2018). In addition, in the presence of their parents compared to an adult, adolescents show more negative connectivity between the VS and mPFC when making risky decisions (Guassi Moreira & Telzer, 2018), suggesting that caregivers boost self-control and reduce risk taking by increasing mPFC activation to downregulate the VS, facilitating more deliberative and safe decisions. Together, these findings indicate that parental social buffering has the potential to reorient neural circuitry to promote more regulated and safe decision-making and highlight the importance of parents to provide a protective role in reducing adolescent risk taking.

Parent Versus Peer Influence

The general assumption is that peers outweigh parents when it comes to influencing adolescents' attitudes and behaviors, particularly in risk-taking contexts. However, experimental neuroimaging research examining the simultaneous effects of parent and peer influence on adolescents' risk behaviors has found that peer influence does not outweigh that of parents, and sometimes parents are more

influential. For instance, adolescents are equally likely to conform to their peers' and their parents' attitudes about risky, health-compromising behaviors (e.g., smoking a cigarette) and prosocial, positive behaviors (e.g., working hard in school), suggesting that parents and peers exert a similar influence on adolescents' attitudes in both negative and positive contexts (Do, McCormick, & Telzer, 2020). At the neural level, adolescents show greater activation in the OFC, pSTS, and dorsolateral prefrontal cortex when conforming to their peers relative to their parents. Thus, despite similar rates of conformity, brain regions associated with reward value, mentalizing, and self-control are more activated when conforming to peers relative to parents.

When more than one social identity is activated, norm conflict may occur, especially if there are inconsistencies across group norms. For instance, when the norms and valued behaviors of the peer group (e.g., drinking alcohol is fun) conflict with the norms internalized at home (e.g., drinking alcohol is an unacceptable behavior), adolescents need to reconcile such differences and decide how to act. We tested how conflicting influence from parents and peers impacts adolescents' risky decisions—when parents endorse safe behavior but peers endorse risks, who do adolescents go along with (Kwon et al., 2021)? Adolescents are more likely to go along with their parents, increasing their risk behavior when their parent endorses the risk but not changing their behavior when their peer endorses the risk. These findings suggest that parents may serve as gatekeepers, granting adolescents permission to be risky as well as buffering the effect of peers' endorsement of risk by endorsing safe behavior. At the neural level, adolescents showe greater vmPFC–striatum connectivity when they aligned their behavior with their parents' risky decisions. The vmPFC–striatum circuit is involved in value-based learning, suggesting that adolescents may be evaluating the social norms set by their peers and parents, integrating the value of going along with their parents relative to their peers, and this reward value prompts a change in their behavior to align with their parents. This research suggests that contrary to popular conceptions that peers have a stronger influence over adolescents than do parents, parents continue to exert meaningful influence on adolescents' risky attitudes and behaviors.

Sibling Influence

While prior research has largely focused on parent and peer influence on adolescent risk taking, the specific role of siblings has received less attention despite being the most enduring relationship affecting individuals throughout their life. Most children (80%) in the United States live with at least one sibling (Kreider, 2008). Importantly, sibling influence on adolescents' risk-taking behavior is greater than that of peers or parents (Duncan et al., 2001; Stormshak et al., 2004), even among nonbiological siblings (McGue et al., 1996). Sibling influence occurs above and beyond the effects of early child aggression, maternal mental health, marital status, family violence, parental criminality, and family income, suggesting that similarity in siblings' risk-taking cannot be fully explained by shared experiences or genetics but is attributed to the sibling relationship itself (Slomkowski et al., 2005). Indeed, we found that adolescents' perceptions of sibling closeness are associated with lower externalizing behavior via heightened AI activation when making safe decisions, an effect that persists above and beyond parental and peer closeness, highlighting the significant protective role of sibling relationships on adolescent externalizing behavior through the brain (Rogers et al., 2018). Interestingly, older siblings' behavior influences adolescents' decisions to engage in, or abstain from, risk taking, particularly among younger siblings who report they model their older sibling, and this is represented in the brain via shared neural patterns between younger and older siblings during risky decision-making in the VS, AI, and vmPFC (Rogers et al., 2021). Thus, in addition to the important role of parents in scaffolding their offspring, siblings are a key relationship affecting adolescents' risky behaviors via the quality of their relationship and through shared neural responses.

Cultural Variations in Family Responsibility

Adolescents are often viewed as irresponsible when it comes to fulfilling family obligations. Indeed, adolescents in the United States see the teen years as a time of individuation from the family and decreasing family responsibility compared to childhood (Qu et al., 2016). Such conceptions are culturally shaped, such that youth in China do not see the teen years as a time of decreasing family responsibility (Qu et al., 2016). For many adolescents, the teenage years represent a time of increased family responsibility, during which youth can contribute in meaningful ways. For instance, among African American, Latinx, and White youth, adolescents contribute to their families by doing things such as running errands for the family (Chiang et al., 2019). Moreover, among youth from Chinese, Mexican, and European backgrounds, youth help their family on the majority of days of the week (e.g., Mexican youth help on 81% of days) by engaging in behaviors such as cleaning their home, taking care of siblings, and running errands for the family (Telzer & Fuligni, 2009).

Supporting the family helps youth to establish themselves as respected and valued members of their family, providing them a sense of happiness and meaning (Telzer & Fuligni, 2009). This sense of meaning provides benefits for adolescents, particularly among Latinx and African American youth, including declines in internalizing symptoms (Telzer, Tsai, et al., 2015), lower substance use (Telzer,

Gonzales, & Fuligni, 2014), lower cortisol awakening response (Armstrong-Carter et al., 2020), and lower levels of inflammatory markers that place youth at risk for poor physical health (Chiang et al., 2019; Fuligni et al., 2009). The meaningfulness of the family is also manifested in the brain, such that Latinx adolescents show heightened activation in the VS when helping their family, whereas White adolescents do not show this heightened VS activation, suggesting that familial support elicits a reward signal, particularly for those who highly value family obligation (Telzer et al., 2010). The more VS activation Latinx youth show when helping their family, the more their depressive symptoms decrease over the high school years (Telzer et al., 2013a), and the lower their risky behaviors are (Telzer et al., 2013b), underscoring that the rewarding nature of familial support is protective and has long term psychosocial benefits for youth.

Summary and Future Directions

In this article, we challenged several widely held stereotypes of teens. Emerging evidence shows that (a) adolescents risk-taking behavior is not inevitable, and risks can be highly adaptive and positive; (b) adolescents are not overly self-centered and motivated by hedonic pleasures but engage in increased prosocial and other-oriented social behaviors; (c) adolescents are not only susceptible to negative peer influence, but peers can influence teenagers in many positive ways; and (d) adolescents do not orient away from the family, but the family remains an important source of influence into adolescence.

Why Do We Need to Challenge These Stereotypes About Adolescents?

Challenging negative stereotypes about adolescence not only clarifies the complexity of adolescent development and behavior but also provides opportunities to promote positive trajectories for youth. Stereotypes about adolescence can shape individuals' behaviors, such that youth who perceive adolescents to be more irresponsible and riskier are more likely to engage in risk-taking behaviors (Buchanan & Hughes, 2009). Neuroimaging evidence suggests that these trajectories are shaped by the developing adolescent brain. For example, middle school students with more negative stereotypes of adolescents' role in the family exhibit heightened activation in the ventrolateral prefrontal cortex during a cognitive control task as well as increases in risk taking in high school (Qu et al., 2018). Thus, challenging negative stereotypes of teens may buffer individuals away from negative trajectories and direct them toward more positive ones. Indeed, in an intervention study, adolescents were presented with information refuting negative stereotypes of teens and tasked with coming up with more positive examples of teenage behavior (Qu et al., 2020). Adolescents in the counterstereotype intervention showed improved academic engagement and reduced risk-taking propensity. These findings indicate an incredible opportunity for the research community—challenging stereotypes about adolescent behavior can impact adolescents' perceptions of teens and promote more positive developmental trajectories.

A Time of Risks and Opportunities

While a general assumption is that youth will either follow positive or negative developmental trajectories, these can occur in tandem, and their intersection may be what makes adolescence a particularly unique period. Indeed, changes in the developing brain support both risk and opportunity. For instance, the common contribution of reward sensitivity to both prosocial and positive risks as well as negative risks suggests the tendency to approach a possibly rewarding event in the spur of the moment may lead adolescents to engage in prosocial behaviors and positive risks in some instances, whereas, in other instances, it may lead individuals to engage in negative risky behaviors. Thus, reward sensitivity is a susceptibility marker for good and potentially bad.

Although risk-taking increases and adolescents are influenced by their peers to engage in socially unacceptable behaviors, in parallel, most adolescents develop social competence, with rises in perspective-taking and in considering the needs of others. As we demonstrate in this review, adolescence is a time of autonomy and resistance to peer influence, when youth are more likely to be influenced in positive prosocial ways than negative antisocial ways, and when they can flexibly deploy cognitive control to meet their motivational goals. Thus, rather than being a developmental period marked by vulnerabilities, a more accurate lens for viewing adolescence is that it is a time of risks and opportunities, and adolescents can develop both in tandem.

Critical Considerations for Future Studies

As the field continues to grow, it is important to note that the very research questions scientists ask can influence society's view on adolescent development, bias research findings and publications, and potentially spur adolescents' self-fulfilling prophecies. We recommend developmental scientists focus on the diverse facets of adolescent development, both positive and negative, that actually occur during adolescence. This focus will move the field forward and have a substantial impact on adolescents' positive development. Below, we outline considerations that researchers can use to reframe their research questions to provide a more balanced perspective on adolescent development, thereby promoting positive development in youth.

Strive for More Research on Adolescents' Positive Development With Strengths-Based Perspectives

As we reviewed, most adolescent research has focused on undesirable behaviors in adolescents, leaving adolescents' positive development overlooked. Indeed, even behaviors that are framed as negative (e.g., risk-taking) might have positive effects in adolescence and into adulthood (e.g., autonomy, prosociality). For instance, recent empirical findings show that sensation seeking during adolescence is positively associated with teens' motivation to contribute to society (Blankenstein et al., 2020; Te Brinke et al., 2022). In addition, brain systems representing positive and negative behaviors are not bifurcated in adolescents, implying a promising intervention opportunity to redirect negative outcomes toward positive ones. Therefore, developing diverse theoretical frameworks and including measures for adaptive behaviors and positive outcomes in future studies are critical to comprehensively understanding adolescent development. A strengths-based perspective emphasizing adolescents' resilience and virtues, relative to the deficits-focused perspective driven by brain immaturities, may be a more effective strategy for research and intervention. For example, scholars elucidated a positive link between adolescents' efficacy beliefs and prosocial action (Hope, 2016), indicating that engagement with strengths-based approaches not only allows scholars to view adolescents holistically but also validates adolescents' beliefs about themselves, which, in turn, helps adolescents flourish.

Consider Culture-Related Individual Differences in Adolescent Development

Our reviewed evidence revealed remarkable individual differences in adolescents' social behaviors and brain development based on teens' sociocultural backgrounds. Hence, future studies should consider within- and between-group variance in behavioral and neural manifestations to obtain a more nuanced picture of adolescent development. Importantly, the perception of whether certain behaviors are adaptive or maladaptive and socially acceptable or unacceptable may also vary across cultures. This will be imperative to the theoretical and practical design of programs for promoting youth's positive development. Furthermore, given that adolescents develop within their cultural and socioeconomic surroundings, understanding what constitutes minoritized adolescents' normative development is critically necessary. This type of research is unfortunately still scarce, especially in developmental neuroscience research (Qu et al., 2021). Notably, most cross-culture studies in the current literature have mainly focused on the developmental differences between East Asian and American adolescents (see Qu et al., 2021, for review). Investigating adolescent development at the global level and including more ethnic/racial groups in study samples will be particularly important for understanding developmental nuances during adolescence. Last, equal access to positive development should also be emphasized in future adolescent work. Strategies to combat disparities in adolescents' positive development must move beyond a mono-cultural understanding of development, see adolescents as respected partners in decision-making, and invest in programs and interventions that fit youth's cultural background and capitalize on adolescents' unique vantage point (Perrin et al., 2020).

Consider Social Contexts in Adolescent Development

Our review shows that developmental outcomes in adolescents may vary as a function of neurobiological sensitivity to social contexts, underscoring the need to understand the social landscape wherein adolescents' behaviors and brains develop. To fully understand how adolescents dynamically interact with their social contexts, ecologically valid and advanced neuroimaging methods are needed. Most adolescent neuroimaging research has been primarily conducted in a "social vacuum" where teens are scanned and removed from their broader social contexts, restricting the real-word implications and external validity. Ecological momentary assessment (EMA) methodology assesses psychological functioning in naturalistic social settings (e.g., school, family). Combining EMA and neuroimaging can strengthen our understanding of how changes in brain processes are associated with adolescents' social behaviors in daily life (see Telzer et al., 2010). Another promising approach to improve the ecological validity of adolescent brain research is to use neuroimaging-based hyperscanning to simultaneously capture the brain activity from multiple individuals and examine interbrain synchrony. Combining this technique with wearable functional near-infrared spectroscopy to investigate interpersonal neural synchronization can shed light on the brain mechanisms underlying dynamic social interaction and collective action (e.g., Reinero et al., 2021). In view of the fact that adolescence is marked by increased social interaction with others and many social behaviors are influenced by parents and/or peers, it will be important to incorporate these advanced methodologies to unravel adolescent brain development in social contexts.

Assess Other Stereotypes of Adolescents

We discussed several stereotypes that broadly exist in the literature and public in this article. Yet, emerging studies indicate other stereotypes of adolescents exist, such as laziness, sleepiness, mood volatility, and mobile phone addiction (e.g., Altikulaç et al., 2019; Crowley et al., 2018; Sahu et al., 2019). One future direction is to evaluate to what extent the empirical evidence supports these stereotypes and whether intervention programs countering adolescent stereotypes (e.g., Qu et al., 2020) change adolescents' moods and social

behaviors via delivering positive messages about the meaning of life.

Conclusions

In this article, we reviewed the theoretical and empirical work on adolescent development in the past decades. To better understand adolescent development, we call for developmental scholars to focus on the diverse facets of adolescent development, including positive aspects of adolescents, in the next generation of research. Ultimately, we provide several interdisciplinary directions that will guide researchers to reframe their research questions to provide a more balanced perspective on adolescent development and thereby promote positive development.

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